

## PHYSICAL AND CHEMICAL PROPERTIES

### Classifying Elements Using Properties

You began this activity by trying to define the meaning of a chemical element. The ancient Greek philosopher Aristotle defined an element as “a body into which other bodies may be analyzed . . . and not itself divisible into bodies different in form.” The first modern definition of chemical element, which is not much different, is from Robert Boyle: “Bodies, which not being made of any other bodies, or of one another, are the ingredients of which all those . . . mixed bodies are . . . compounded.” We now state that an element is any material that cannot be broken down by chemical means into simpler materials.

Before the mid-19th century, scientists were preoccupied with discovering elements and observing and recording their properties. Then they tried to organize the elements they had discovered in a useful way. At first, they listed the elements alphabetically. However, every time a new element was discovered, the whole list had to be changed. They tried other methods. Could elements be organized by properties like state, color, or taste? None of these methods appeared practical or safe! However, chemists worldwide were sure that elements existed in families that had similar physical and chemical properties. To the Russian scientist, Dimitri Mendeleev (1843-1907), the development of a tool to organize the elements began the same way that so much of science inquiry begins, with a simple question. The question Mendeleev wanted answered was: “What is the relationship of the elements to one another and to the chemical families to which



## Checking Up

1. Define a chemical element.
2. What question did Mendeleev use to guide his science inquiry?
3. In your own words, describe the difference between a physical and a chemical property.

### Chem Words

**physical property:** a property that can be measured without causing a change in the substance's chemical composition.

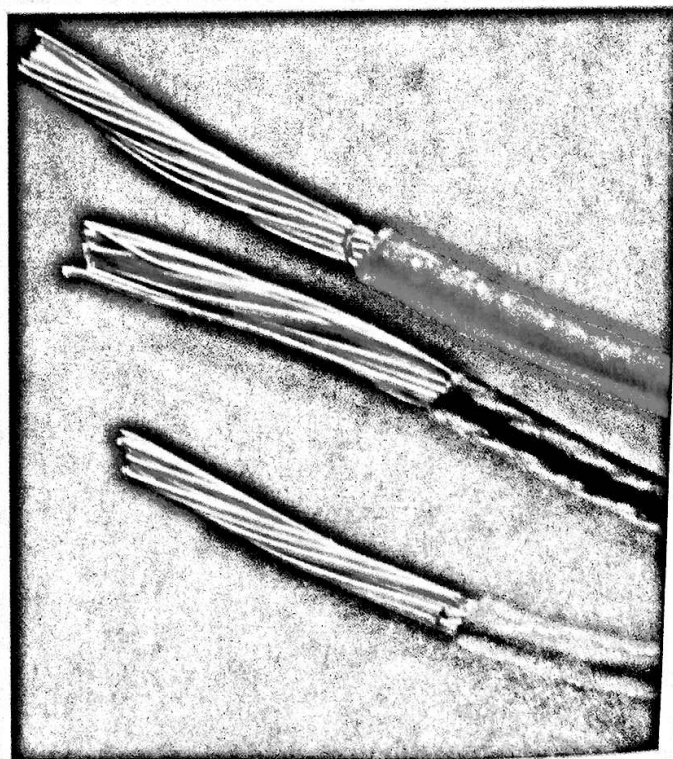
**chemical property:** a characteristic that a substance undergoes in a chemical reaction that produces new substance(s).

they belong?" At that time there were 63 known elements. To help him with his organization, he developed a card game, much the same as you did in this activity. He wrote the properties of each known element on a different card and then spent many hours arranging and rearranging the cards. He was looking for patterns or trends in the data in front of him. Mendeleev, however, had more information on his cards than you presently have. In the following activities, you will look at additional properties of elements that will help you organize your game.

## Physical and Chemical Properties

In this activity you observed several properties of the elements you were provided. You probably initially observed the color and the state of the element. You then investigated whether or not the chemical element conducted electricity. You could have also observed the luster, measured the density

or the strength, or determined the malleability of each element. In each case, you would not have changed the element itself. In this investigation the element still looked the same in the jar after you removed the electrical conductivity apparatus as it did when you initially inserted it. If measuring a property of a substance does not change the chemical identity of one substance, it is called a **physical property**.



On the other hand, when you observed whether the chemical element reacted with hydrochloric acid, the element clearly changed.

A **chemical property** is the kind of reaction that a substance undergoes. Measuring chemical properties changes the chemical composition of a substance.